

What is claimed is:

1. An isolated DNA molecule comprising a DNA sequence encoding a BMP receptor protein.

2. The DNA molecule of claim 1, wherein said DNA sequence is selected from the group consisting of:

(a) nucleotides 61 to 1656 of SEQ ID NO: 1;

(b) nucleotides 247 to 1752 of SEQ ID NO: 3; and

(c) sequences which hybridize to (a) or (b) under stringent hybridization conditions and encode a BMP receptor protein with the ability to bind to BMP in a binding assay.

3. An isolated DNA molecule comprising a DNA sequence encoding a serine/threonine kinase receptor protein, wherein the DNA sequence is selected from the group consisting of:

(a) nucleotides 474 to 2000 of SEQ ID NO: 5;

(b) nucleotides 80 to 1594 of SEQ ID NO: 7;

(c) nucleotides 83 to 1591 of SEQ ID NO: 9;

(d) sequences which hybridize to any of (c) to (e) under stringent hybridization conditions and encode a serine/threonine receptor protein.

4. The DNA molecule of claim 1, wherein said DNA sequence is selected from the group consisting of:

(a) nucleotides encoding for amino acids 24 to 532 of SEQ ID NO: 2; and

(b) nucleotides encoding for amino acids 8 to 502 of SEQ ID NO: 4; and

(c) sequences which hybridize to any of (a) or (b) under stringent hybridization conditions and encode a BMP receptor protein with the ability to bind to BMP in a binding assay.

5. An isolated DNA molecule comprising a DNA sequence encoding a serine/kinase receptor protein, wherein the DNA sequence is selected from the group consisting of:

(a) nucleotides encoding for amino acids 18 to 509 of SEQ ID NO: 6; and

(b) nucleotides encoding for amino acids 24 to 505 of SEQ ID NO: 8; and

(c) nucleotides encoding for amino acids 30 to 503 of SEQ ID NO: 10; and

(d) sequences which hybridize to any of (a) to (c) under stringent hybridization conditions and encode a serine/threonine kinase receptor protein.

6. A host cell transformed with the DNA molecule of claim 1.

7. A host cell transformed with the DNA molecule of claim 2.

8. A host cell transformed with the DNA molecule of claim 4.

9. A host cell transformed with the DNA molecule of claim 5.

5 10. An isolated DNA molecule having a sequence encoding a truncated BMP receptor protein which is characterized by the ability to bind to BMP in a binding assay, said DNA molecule comprising a DNA sequence selected from the group consisting of:

(a) nucleotide 61 to 507 of SEQ ID NO:1;

(b) nucleotides encoding amino acids 1 to 149 of SEQ ID NO:2;

(c) nucleotide 247 to 618 of SEQ ID NO:3;

10 (d) nucleotides encoding amino acids 8 to 124 of SEQ ID NO:4; and

(e) naturally occurring allelic sequences and equivalent degenerative codon sequences of (a), (b), (c) or (d).

11. A host cell transformed with the DNA molecule of claim 10.

15 12. A vector comprising a DNA molecule of claim 10 in operative association with an expression control sequence therefor.

13. A method for producing a purified truncated BMP receptor protein, said method comprising the steps of:

(a) culturing in a culture medium a host cell transformed with a DNA sequence according to claim 10, comprising a nucleotide sequence encoding a truncated BMP receptor protein; and

20 (b) recovering and purifying said truncated BMP receptor protein from the culture medium.

14. A purified truncated BMP receptor protein comprising the amino acid sequence from amino acid 24 to amino acid 149 of SEQ ID NO: 2.

25 15. A purified truncated BMP receptor protein comprising the amino acid sequence from amino acid 8 to amino acid 124 of SEQ ID NO: 4.

16. A purified truncated BMP receptor protein produced by the steps of:

(a) culturing in a culture medium a cell transformed with a DNA comprising the nucleotide sequence from nucleotide 61 to 507 of SEQ ID NO: 1; and

30 (b) recovering and purifying from said culture medium a protein comprising the amino acid sequence from amino acid 24 to amino acid 149 of a sequence selected from the group

consisting of SEQ ID NO: 2.

17. A purified truncated BMP receptor protein produced by the steps of:

(a) culturing in a culture medium a cell transformed with a DNA comprising the nucleotide sequence from nucleotide 247 to 618 of SEQ ID NO: 3; and

5 (b) recovering and purifying from said culture medium a protein comprising the amino acid sequence from amino acid 8 to amino acid 124 of a sequence selected from the group consisting of SEQ ID NO: 4.

18. A method for producing a truncated BMP receptor protein, said method comprising the steps of:

10 (a) culturing in a culture medium a host cell transformed with a DNA sequence encoding a truncated BMP receptor protein, comprising a truncated nucleotide sequence encoding the ligand binding domain of a BMP receptor protein; and

(b) recovering and purifying said BMP receptor protein from the culture medium.

15 19. A method for producing a truncated BMP receptor protein, said method comprising the steps of:

(a) culturing in a culture medium a host cell according to claim 11, comprising a truncated nucleotide sequence encoding the ligand binding domain of a BMP receptor protein; and

(b) recovering and purifying said BMP receptor protein from the culture medium.

20 20. An isolated DNA molecule having a sequence encoding a truncated serine/threonine kinase receptor protein, said DNA molecule comprising a DNA sequence selected from the group consisting of:

(a) nucleotide 474 to 836 of SEQ ID NO:5;

(b) nucleotides encoding amino acids 1 to 121 of SEQ ID NO:6;

25 (c) nucleotide 80 to 445 of SEQ ID NO:7;

(d) nucleotides encoding amino acids 1 to 122 of SEQ ID NO:8;

(e) nucleotide 83 to 445 of SEQ ID NO:9;

(f) nucleotides encoding amino acids 1 to 121 of SEQ ID NO:10; and

(e) naturally occurring allelic sequences and equivalent degenerative codon sequences of
30 (a) through (f).

21. A host cell transformed with the DNA molecule of claim 20.

22. A vector comprising a DNA molecule of claim 20 in operative association with an expression control sequence therefor.

5 23. A method for producing a purified truncated serine/threonine kinase receptor protein, said method comprising the steps of:

(a) culturing in a culture medium a host cell transformed with a DNA sequence according to claim 20, comprising a nucleotide sequence encoding a truncated serine/threonine kinase receptor protein; and

10 (b) recovering and purifying said truncated serine/threonine kinase receptor protein from the culture medium.

24. A purified truncated serine/threonine kinase receptor protein comprising the amino acid sequence from amino acid 1 to amino acid 121 of SEQ ID NO: 6.

25. A purified truncated serine/threonine kinase receptor protein comprising the amino acid sequence from amino acid 1 to amino acid 122 of SEQ ID NO: 8.

15 26. A purified truncated serine/threonine kinase receptor protein comprising the amino acid sequence from amino acid 1 to amino acid 121 of SEQ ID NO: 10.

27. A method for producing a truncated serine/threonine kinase receptor protein, said method comprising the steps of:

20 (a) culturing in a culture medium a host cell transformed with a DNA sequence encoding a truncated serine/threonine kinase receptor protein, comprising a truncated nucleotide sequence encoding the ligand binding domain of a serine/threonine kinase receptor protein; and

(b) recovering and purifying said truncated serine/threonine kinase receptor protein from the culture medium.

25 28. A method for producing a truncated serine/threonine kinase receptor protein, said method comprising the steps of:

(a) culturing in a culture medium a host cell according to claim 21, comprising a truncated nucleotide sequence encoding the ligand binding domain of a serine/threonine kinase receptor protein; and

30 (b) recovering and purifying said truncated serine/threonine kinase receptor protein from the culture medium.

29. A DNA molecule encoding a BMP receptor protein isolated through a method comprising:

(a) preparing a DNA fragment encoding a ligand binding domain of a known BMP receptor protein as a probe;

5 (b) screening a genomic or cDNA library, using the DNA fragment of (a) as a probe;

(c) isolating a DNA molecule which hybridized to the probe identified in step (b); and

(d) cloning a DNA molecule encoding a BMP receptor protein from the DNA molecule of step (c).

30. The BMP receptor protein of claim 29, wherein the known BMP receptor protein
10 is CFK1-23a or CFK1-43a.

31. An isolated DNA molecule comprising the DNA sequence of CFK1-23a.

32. An isolated DNA molecule comprising the DNA sequence of CFK1-43a.

33. An isolated DNA molecule comprising the DNA sequence of CFK1-10a.

34. An isolated DNA molecule comprising the DNA sequence of W-101.

15 35. An isolated DNA molecule comprising the DNA sequence of W-120.

36. A composition comprising cells transformed with a DNA molecule comprising a DNA sequence encoding one or more BMP receptor proteins.

37. A ligand which binds to a truncated BMP receptor protein, said ligand being selected from the group consisting of an BMP-like monoclonal antibody, a small peptide BMP analogue,
20 and a small organic molecule BMP analogue.

38. The ligand of claim 37, comprising a BMP-like monoclonal antibody.

39. The ligand of claim 37, comprising a small peptide BMP analogue.

40. The ligand of claim 37, comprising a small organic molecule BMP analogue.

41. A pharmaceutical composition comprising a compound first identified for such use
25 as a ligand for the truncated BMP receptor of claim 20.

42. The composition of claim 41, comprising an BMP-like monoclonal antibody.

43. The composition of claim 41, comprising a small peptide BMP analogue.

44. The composition of claim 41, comprising a small organic molecule BMP analogue.

45. A ligand for the truncated BMP receptor protein produced by the method of claim
30 13, said ligand being selected from the group consisting of an BMP-like monoclonal antibody,

a small peptide BMP analogue, and a small organic molecule BMP analogue.

46. The ligand of claim 45, comprising an BMP-like monoclonal antibody.

47. The ligand of claim 45, comprising a small peptide BMP analogue.

48. The ligand of claim 45, comprising a small organic molecule BMP analogue.

5 49. A pharmaceutical composition comprising a compound first identified for such use
as a ligand for the truncated BMP receptor produced by the method of claim 14.

50. The composition of claim 49, comprising an BMP-like monoclonal antibody.

51. The composition of claim 49, comprising a small peptide BMP analogue.

52. The composition of claim 49, comprising a small organic molecule BMP analogue.